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Description

OPTICAL SENSOR CLEANER

BACKGROUND OF INVENTION

[0001] The illustrative embodiments disclosed in the present application are useful in systems including those for cleaning systems having paper paths and more particularly are useful in systems including those for cleaning optical sensors located in a system including a paper feed path with rollers.

[0002] Many types of mail and paper handling equipment are in use today. Such equipment is often designed to accommodate varying types of media that may include letter-sized sheets of paper, stuffed envelopes and empty envelopes. The paper handling machines typically include a paper-handling path including a paper transport using friction rollers that have a rubberized surface. Some of the machines utilize opposing rollers to form nips that grab and transport the media. Other machines use a roller and an opposing guide and/or registration wall to transport the paper. These types of machines often use non-contact

optical sensors to determine the media position inside the paper path. As many pieces of paper or envelopes are processed through such a machine, there is a likelihood that debris such as paper dust particles will accumulate in the machine.

[0003] Accordingly, debris generated during machine operation may contaminate the optical sensors located in the mail and paper handling equipment. Such contamination may be even more likely for sensors that are located below the paper deck because gravity may cause debris to collect on those sensors. As the machine is used, debris builds up over time on the surface of the sensor and the accuracy of the sensor is degraded. Accordingly, the debris degrades the ability of the sensor to track paper movement through the paper path. While the sensor may otherwise be functioning properly, the debris condition may cause a failure of the sensor and cause the user to place a service call. Such service calls may be costly.

[0004] A representative mailing machine having a paper path and paper transport is shown in U.S. Patent No. 6,499,020, issued on December 24, 2002 to Dolan, et al. A non-contact optical sensor is provided downstream of a paper transport roller.

[0005] Cleaning sheets for systems such as bill identification units are described in United States patent no. 6,353,233, issued March 5, 2002 to Kikuchi, et al. Kikuchi describes a brush formed on the surface of a cleaning sheet for cleaning recessed sensors that are not relatively close to the feed path rollers. The brushes consist of nylon fibers or acrylic copper sulfide fibers. Brushes typically bend down when forced through a roller and then rotate back to a vertical position after the entire horizontal length of the brush fiber passes through the roller. Cleaning sheet materials for cleaning conveying rolls and guides of a facsimile apparatus are described in United States patent no. 4,611,361, issued September 16, 1986 to Shinkai. Shinkai describes impregnated sheets for cleaning and an absorbent sheet with a woven fiber having a nap. The nap lies down horizontally when the sheet is flattened through the rollers and then rotates back to a vertical position.

[0006] Accordingly, the prior art does not provide for a cleaning sheet for cleaning optical sensors that are located near the transport rollers.

SUMMARY OF INVENTION

[0007] A paper path optical sensor cleaner is described having a substrate sheet with strips of open cell foam adhered

across the width of the sheet. The optical sensors include non-contact sensors that are located below the plane of the paper path. The strips of open cell foam have a height greater than the distance from the paper path to the top of the sensor and a width that is sufficiently narrow to allow the cleaning strips to expand to clean a sensor located in close proximity to a paper path roller. As the substrate is fed through the paper path, the strips of open cell foam are vertically compressed when passing through the paper path feeder rollers. As the strips begin to pass the roller, the leading edge of the open cell foam partially expands downward to contact the sensor followed by the rest of the strip.

Brief Description of Drawings

[0008] FIG. 1 is a side view of an optical sensor cleaner in a representative paper path according to an illustrative embodiment of the present application.

[0009] FIG. 2A is a perspective view of an optical sensor cleaner according to an illustrative embodiment of the present application.

[0010] FIGs. 2B-2G are side views of alternative cleaning strips for an optical sensor cleaner according to additional illustrative embodiments of the present application.

[0011] FIG. 3 is a side view of a paper path cleaner in a representative paper path according to another illustrative embodiment of the present application.

DETAILED DESCRIPTION

[0012] Illustrative embodiments describing optical sensor cleaning sheets for cleaning paper paths are described. The illustrative embodiments include cleaning cards or sheets with one or more strips or pads of lint-free, compressible material attached to them. The illustrative embodiments herein are described with reference to a representative mailing machine having a paper path and paper transport including friction rollers. However, the embodiments described may also be advantageously used with other systems having paper paths and transports such as document inserters and printers.

[0013] The cleaning sheets described provide several advantages over the prior art, including, but not limited to, providing a cleaning sheet for cleaning optical sensors that are located relatively near the transport rollers.

[0014] Traditionally, optical sensors in a mailing machine are cleaned during a service call by a technician. The technician uses forced air to blow debris off the sensor. As the debris builds up in the equipment over time, forced air

may not sufficiently clean the sensor. The technician may then resort to wiping the sensor surface with a dry lint-free swab. Accordingly, the service representative must know the location of the sensors.

[0015] The optical sensor cleaners described herein provide a low cost device for cleaning debris from optical sensors that can be used by a typical machine operator. Accordingly, debris buildup on the sensor will no longer require an expensive service call because the low cost devices described herein could be used to clear the debris. The devices described herein allow an operator to clean the optical sensor without having to disassemble the machine, locate the sensors and inspect the sensors for debris.

[0016] The present application describes illustrative optical sensor cleaning devices having strips of open cell foam attached to a substrate. The representative mailing machine includes an optical sensor in relatively close proximity to a roller in the feed path. As the optical sensor cleaner is fed through the paper path, the strips compress through the roller. As each strip begins to exit the roller, the strip immediately expands to contact the sensor, thereby wiping the sensor clean. The open cell foam strips have a width of approximately one half inch and are spaced apart ap-

proximately two and one half inches on the substrate.

[0017] In a preferred embodiment, the cleaning strips include open cell foam because it will more quickly return to its expanded height as it exits from the transport rollers than would closed-cell foam. However, other foams may also be used. In a preferred embodiment, a substrate card of ABS material has non-abrasive, lead-free, open-cell foam strips attached to it. The substrate card or sheet is approximately the size of a typical large substrate handled by the machine and provides handling areas so that the card may be manually pushed or pulled through the machine when the paper transport is not operating. Alternatively, the cleaning card may be run through the machine when the paper transport is working.

[0018] The representative optical sensor shown is a non-contact photo sensor in a mailing machine. Accordingly, the cleaning card is the size of a standard number 10 envelope. The bottom major edge is fed first into the feed path. Such envelopes are 4 and one-eighth inches on the minor edge and 9 and one half inches on the major edge. Accordingly, a preferred cleaning card substrate is approximately five inches on the minor edge and eight and one half inches on the major side. In an alternative, in or-

der to provide a handle to move the card, the major edge is four inches longer and a checkered grip is provided on the ABS surface. In another alternative, the cleaning sheet device substrate includes acrylic or semi-rigid vinyl material.

[0019] Referring to FIG. 1, a side view of an optical sensor cleaner 100 according to an illustrative embodiment of the present application is shown in relation to a representative paper path of a mailing machine.

[0020] The partial mailing machine paper path and transport shown is representative of a machine that may be cleaned using the cleaning devices described herein. The transport includes friction rollers 120, 122, 124, 126 and 128. The rollers are typically rubberized in order to provide a friction grip with the media fed through the paper path. The opposing rollers rotate to form a nip that urges media such as envelopes in direction A.

[0021] The mailing machine also includes non-contact optical sensors 130 and 132. The cleaning card 100 includes a substrate sheet 110 that is preferably ABS material that is 0.0625 inches thick. Alternatively, the thickness of the substrate sheet may be varied as appropriate for the particular type of machine to be cleaned. The illustrative

cleaning card 100 includes five cleaning strips 112, 114, 116, 118 and 119 that preferably include lint-free, lead-free, non-abrasive, open-cell foam. The cleaning strips are attached to the substrate sheet in intervals and are glued to the substrate sheet transverse to the direction of travel A. In an alternative, the number of strips may be varied and the interval between strips may be varied. In another alternative, the strips do not extend across the entire substrate sheet 110 because the position of the LED devices may not require coverage across the entire sheet.

[0022] As the cleaning sheet 100 is fed manually through the mailing machine, the cleaning strips are compressed by the rollers and then expand as they exit the rollers. At the time shown in FIG. 1, rollers 128 and 124 have compressed cleaning strips 119 and 118 respectively. Cleaning strip 116 is fully expanded after having cleaned optical sensor LED 132. Cleaning strip 114 has partially exited roller 122 and is partially expanded vertically to clean optical sensor LED 132. Cleaning strip 112 is partially compressed vertically and cleaning optical sensor LED 130.

[0023] In yet another alternative, the cleaning sheet 100 is fed through the mailing machine while the paper transport is activated.

[0024] Referring to FIG. 2A, a perspective view of the optical sensor cleaner 100 according to an illustrative embodiment of the present application is shown.

[0025] The cleaning sheet substrate 110 is 0.0625 inches in thickness E including ABS material and is 8.5 inches in the major edge and 5 inches in the minor edge. Cleaning strips 112, 114, 116, 118 and 119 are open cell foam attached to the substrate 110 using a permanent adhesive. The substrate 110 has a leading section and a trailing section F that is 1 inch in the major edge direction A. The height B of the foam cleaning strips is 0.75 inches. The foam strips are 0.5 inches wide C. In a preferred embodiment, the cleaning foam strips are evenly spaced D. In an alternative, three cleaning strips are used and they are evenly spaced 2.5 inches apart on a substrate having a one-inch lead space and a one-inch trailing space.

[0026] In another alternative embodiment, foam strips with bristles on the top of the strips are used. The strips include a foam/bristle combination such as those used in some paint applicators. However, in such a system, the bristles may shed and provide additional debris. Accordingly, one or more of the final strips of foam may be provided without bristles so that the rear strips clear any bristles that

have shed from the front foam strips.

[0027] Referring to FIGs. 2B-2G, side views of alternative cleaning strips for an optical sensor cleaner according to additional illustrative embodiments of the present application are shown.

[0028] In one embodiment shown above, the cleaning strips have a rectangle profile and the trailing edge does much of the cleaning.

[0029] Alternative cleaning strip 210 has the profile shown in which the leading edge is angled to the back edge.

[0030] Alternative cleaning strip 212 has the profile shown in which the leading edge is angled to the middle of the top edge.

[0031] Alternative cleaning strip 214 has the profile shown in which the leading edge and trailing edge are both angled from the attachment end to the center point of the distal top edge.

[0032] Alternative cleaning strip 216 has the profile shown in which the leading edge and trailing edge are both angled from the middle of each side to the center point of the distal top edge.

[0033] Alternative cleaning strip 218 has the profile shown in which the leading edge is angled to the back edge and the

cleaning surface includes a debris gathering gap.

[0034] Alternative cleaning strip 220 has the profile shown in which the top edge includes two equally spaced notches.

[0035] Referring to FIG. 3, a side view of a paper path cleaner according to another illustrative embodiment of the present application is shown in relation to a representative paper path of a mailing machine.

[0036] The partial mailing machine paper path and transport are shown and are representative of a machine that may be cleaned using the cleaning device described herein. The transport includes friction rollers 320, 322, 324, 326 and 328. The rollers are typically rubberized and opposing rollers rotate to form a nip that urges media such as envelopes in direction A.

[0037] The mailing machine also includes non-contact optical sensors 330 and 332. The cleaning card 300 includes a substrate sheet 310 that is preferably ABS material that is 0.0625 inches thick. The substrate sheet 310 has a top surface 360 and a bottom surface 340. A cleaning pad 390 is attached to the top surface 360. As the cleaning sheet 300 is manually fed through the paper transport, cleaning pad 390 cleans rollers 320 and 326.

[0038] Alternatively, the bottom surface 340 and top surface 360

include a tacky substance for cleaning the rollers 320, 322, 324, 326 and 328.

[0039] The described embodiments are illustrative and the above description may indicate to those skilled in the art additional ways in which the principles of this invention may be used without departing from the spirit of the invention. Accordingly, the scope of each of the claims is not to be limited by the particular embodiments described.